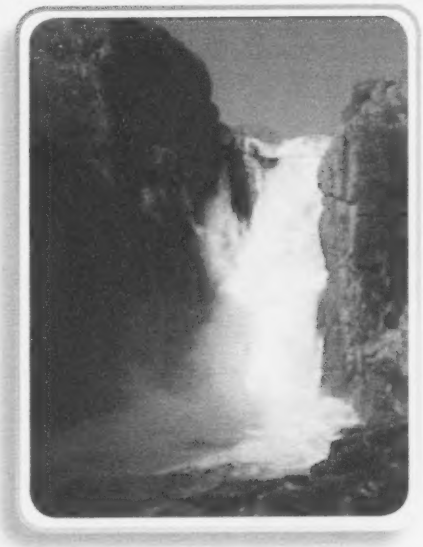
A Discussion Paper for Ikummatiit

- an Energy Strategy for Nunavut -



Energy Secretariat
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Message from the Minister

Nunavut is unique in Canada because it is totally dependent upon fossil fuels for its energy needs. Unlike most other jurisdictions, Nunavut does not currently employ other options—such as hydro or wind power—for generating electricity. This situation is further exacerbated by the fact that all of the fossil fuel is imported in bulk once per year. Simply stated, it is not wise to be dependant upon a single energy source.

It is vital that Nunavut develop an energy strategy to lessen our dependence upon a finite energy resource and to plan for our future. I believe that the main thrust of this new strategy should be to investigate other forms of energy and to encourage our citizens to be more conservation minded. A Nunavut energy strategy will create a policy and fiscal framework to guide our decisions on energy supply and help to reduce our dependency on imported fossil fuels.

As this is both a short-and long-term process, this document will serve as the first stage in moving us towards the creation of a comprehensive energy strategy. It provides several options and approaches to advance energy efficiency and reduce our demand for fossil fuel.

On one hand, Nunavummiut will have to undergo a change in mindset on energy supply and energy conservation. On the other, the public sector, including the Government of Nunavut and its agencies, may have to consider organizational improvements to enhance services and lower costs. A foundation needs to be laid for effective personal and corporate participation in Nunavut's energy future.

In examining approaches to managing our energy use and resources, Nunavummiut will join other Canadians who are challenging the idea that energy is cheap, plentiful and can be used without regard to the environment.

The Government of Nunavut welcomes suggestions and input from Nunavummiut as we develop our energy strategy. This document provides ways for you to share your views and ideas, and I look forward to working with you to reduce our consumption of fossil fuels and secure our energy future.

Edward Picco

The Hon. Edward Picco
Minister of Energy

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Introduction

The purpose of this document is to provide information to Nunavummiut about our current energy situation, the challenges and opportunities that we face, and to solicit your comments and suggestions on ways that we can make it better. We will need to be resourceful and innovative, and we will need to work together to ensure that our energy system is sustainable and affordable.

The Government of Nunavut (GN) purchases all of Nunavut's fuel and it is also one of the largest energy consumers in the Territory. It creates public policy and controls spending, and it, directly or indirectly, pays approximately 80 percent of the Territory's energy bill. Consequently, our new energy strategy will need to address the role of the Government of Nunavut and its agencies.

Our Vision

In developing our energy strategy, we will need to create a common vision for Nunavut's Energy System. An example of how this can be expressed is:

"An energy strategy that leads to a sustainable energy system which is secure, environmentally responsible, and optimizes the economic benefits for Nunavummiut, both today and tomorrow"

The Need for an Energy Strategy

The Nunavut Energy System is on the verge of fundamental change. International events have increased its costs, and as a result, the Government of Nunavut is reviewing the current energy system in order to develop a forward-looking energy strategy—one that will meet the needs of today and tomorrow and will conform to the values of Nunavummiut.

Developing a new and innovative energy strategy presents an opportunity to provide a long-term plan for a sustainable energy system. To be sustainable the energy system must be affordable, secure, environmentally responsible, increase the use of renewable and domestic energy resources, and optimize the economic benefits for Nunavummiut.

Successfully implemented, it will enable the government and Nunavummiut to better manage Nunavut's growth and use incentives more than subsidies to encourage conservation. This would allow the transfer of funds to other essential government services, such as health care and education. At the same time it will reinforce our *Avatittinnk Kamatsiarhiq* values.

This is an exciting time for Nunavut to be pursuing new opportunities in the energy sector. Rapidly evolving energy management and renewable energy technologies offer employment and business opportunities for Nunavummiut, while reducing the environmental and economic cost of providing energy services to Nunavut. Volatile international oil prices bring our domestic hydro, natural gas, oil and uranium resources closer to their economic development threshold. At the same time, international attention to climate change necessitates a review of our reliance on fossil fuels.

Creating a new energy strategy is an important goal for all our citizens and businesses, and a positive step along the road to achieving the Government's *Pinasuaqtavut* mandate.

Guiding Principles

Ikummatiit, the name for our proposed energy strategy, will reflect *Pinasuaqtavut 2004-2009* and Inuit Qaujimjatuqangit principles. One of the key objectives in *Pinasuaqtavut 2004-2009* is to conserve and reduce the use of energy and find alternatives to diesel fuel for electricity generation.

Our work will be within the spirit of Inuit Qaujimajatuqangit principles of *Aajiiqatigiiniq* (decision making through discussion and consensus), *Piliriqatigiinniq* (working together for a common cause), *Qanuqtuurniq* (being innovative and resourceful) and *Avatittinnik Kamatsiarniq* (respect and care for the land, animals and the environment.)

To be successful the new energy strategy will need to meet both short- and long- term goals. The government will need to provide new services that support energy conservation, alternative energies and ensure that our energy system is affordable and secure.

Goals

To increase the sustainability of our current energy system we need to consider goals, such as these, in our energy strategy.

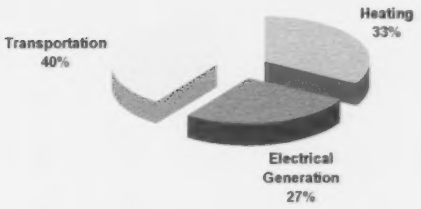
- Improve the security of our energy system by reducing our reliance on imported fossil fuels, and diversifying our energy sources to include clean, alternative energy and domestic energy sources.
- Improve the affordability of energy for services such as heat, hot water, lighting, and transportation by reducing the cost of providing energy and improving the efficiency of its use.
- Reduce the impact on our environment by reducing the energy-related emissions that contribute to climate change.
- Provide business and employment opportunities to Nunavummiut and Nunavut's businesses by increasing energy efficiency and by using renewable and domestic energy sources.

Nunavut's Current Energy System

Nunavut uses imported fossil fuels to generate electricity, heat its buildings and transport its goods and citizens. The fossil fuels are shipped in bulk to Nunavut during the short, open-water shipping season and stored in facilities in each community. Local storage imposes environmental risks from leaks and spillage and finite storage capacity poses an energy security risk.

As a result, the cost in both environmental and economic terms is high and many of the economic benefits are exported to the south. Furthermore, the energy supply is not secure as it is influenced by international events beyond our control, nor is the cost manageable as it is subject to the volatile, international price of oil.

Figure 1: Fossil Fuel Consumption in Nunavut



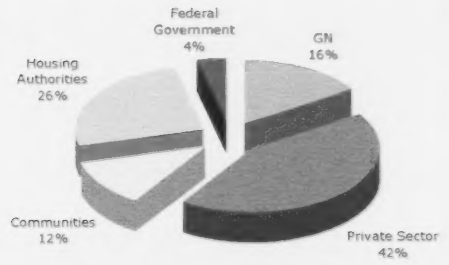
The Government of Nunavut, through its Petroleum Products Division (PPD), purchases all of the Territory's fossil fuel. In 2006, PPD spent about $130 million to purchase 165 million litres of fossil fuel. Forty percent of this fuel was used to transport people and goods, 33 percent heated buildings and 27 percent generated electricity (Figure 1). The dollar expenditure represented nearly 20 percent of the GN's $1 billion annual budget.

PPD resells the fossil fuels to private and public sector consumers, and in some communities, local contractors ship the fuel products to their end users.

Energy is an essential commodity to sustain life in Canada's Eastern Arctic. The government subsidizes the cost of energy for many of its consumers. The subsidy varies between the different consumer groups regardless of the efficiency of its use. Because the subsidy is based on price, it can be a deterrent to efficient energy use[1].

Space and Water Heating

Figure 2: Heating Fuel Consumption



Twenty-three percent of the fossil fuel (59 million litres) that was sold in 2006 by PPD was used to heat our buildings and our residential water. It was burned in furnaces, boilers and water heaters in individual buildings. Private sector businesses and homeowners (42 percent) are the two largest consumers of fuel in Nunavut, followed by housing authorities (26 percent), and the Government of Nunavut (16 percent). The 26 community governments and the federal government use 12 percent and four percent respectively (Figure 2).

The combustion of fossil fuels contributes to climate change. For example, it is estimated that the greenhouse gas emissions from the light oil used to heat Nunavut's water and buildings are 167,000 tonnes of CO_{2eq}.

1 For further information on the GN's fuel and electricity subsidies please see the Backgrounder : Government & Utility Policies & Programs

Space and Water Heating Energy Supply Options[2]

There are a limited number of economic options to the burning of fossil fuel for space and water heating available to Nunavut in the short term. However, passive and active solar energy can be economically used to offset some of the need for fossil fuels.

- Both solar water heating and solar air heating can economically replace some of the fossil fuel consumed for space and water heating.
- If Nunavut develops hydro power, electric heat and hot water can replace imported fossil fuels.

Space and Water Heating Energy Management Options

The amount of fuel oil consumed in a building is affected by the construction of the building, the efficiency, quality and quantity of the equipment that is used, and the behaviour of the building's occupants.

Much of the existing equipment and systems that heat Nunavut's buildings and water is more than 20 years old and inefficient by today's standards. Modern energy-efficient equipment and systems, better trained building operators and managers, and educated and motivated building occupants can provide fuel savings of between 15 percent and 30 percent. There are numerous economic measures that can be adopted to improve the energy efficiency of Nunavut's existing building stock. Energy management options can include: capital-intensive measures that require a building owner to invest in their building (for example, purchasing a new high-efficiency furnace), to simple changes in behaviour, such as turning down the thermostat when the building is unoccupied.

Transportation

Nunavut's communities are in an area of more than 1.9 million square kilometres. Consequently, the high cost of fuel affects all aspects of life. For example, a significant percentage of Nunavut's food supply is moved by air, and personal travel between communities is almost exclusively by air. This means rising fuel costs adversely impact all people in Nunavut. There is a GN subsidy on transportation in recognition of the importance of travel to life in Nunavut.

Transportation accounted for 41 percent of Nunavut's energy consumption in 2006. In 2006, aviation fuel use accounted for 62 percent of the transportation fuel used (41.5 million litres), gasoline for 27 percent (18 million litres) and diesel the remaining 10 percent (seven million litres).

Transportation Energy Supply Options

A number of economic options are available to reduce the greenhouse gases associated with the burning of gasoline and diesel fuel in vehicles.

- Biodiesel can be used in any diesel engine with few or no modifications, and can be blended with petroleum diesel at any level. Elsewhere in Canada, biodiesel is widely used

2 A more complete description of the Solar Heating Options and other Renewable Energy Options is included in the Energy Supply Options Backgrounder.

by governmental and commercial fleets, passenger vehicle owners, and construction equipment. Biodiesel blends of B20 (20 percent biodiesel and 80 percent regular diesel blend) and lower can be used in cold climates, if the blend has appropriate cold-flow properties.

- Increased use of ethanol/gasoline mixes can reduce greenhouse gas emissions, but cost more than conventional gasoline and require heaters in arctic climates.

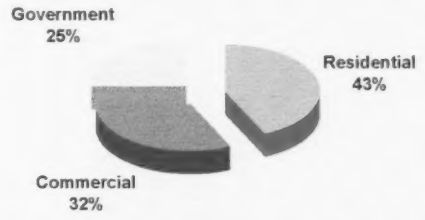
Transportation Energy Management Options

Several options are available to improve the efficiency of vehicle operation and to discourage the sale of "gas guzzlers".

- Proper tune-ups and regular maintenance, such as correct tire inflation, can improve the mileage of existing vehicles and reduce emissions of greenhouse gases.
- The GN can discourage the sale of "gas guzzlers" by adopting fuel-efficiency standards.
- The GN can introduce a graduated license fee structure that increases the cost for inefficient vehicles and reduces the cost for efficient vehicles.

Electricity

Figure 3: Electricity Sales



In 2006, PPD sold 44 million litres of fossil fuel to Qulliq Energy Corporation (QEC) to generate electricity. This represents 27 percent of all of the fossil fuel purchased by the Government of Nunavut. There are significant subsidies and transfer payments associated with the sale of electricity. Approximately 49 percent of QEC's revenue is collected through revenue transfers from "related parties" such as the GN. In 2006, 43 percent of electricity sales were to residential customers, 32 percent to commercial customers, and 25 percent to the Government of Nunavut.

QEC's internal efforts have improved the efficiency of its diesel power plants and it plans to further improve this by incorporating higher efficiency generators and cleaner fuels in the future. These plants typically produce electrical energy at an overall thermal efficiency of about 35 percent. That is, the plant uses about 35 percent of the thermal energy in the diesel fuel to produce electrical energy. The balance of energy in the fuel is dissipated into the atmosphere in the form of heat. QEC uses residual heat from the generation process in several locations for heating the plant, offices and neighbouring buildings.

Electricity Supply Options[3]

There are several alternatives to generating electricity from fossil fuels, including hydro, wind, solar, biomass, and nuclear power. All of these options have advantages and limitations in arctic climates and will need further study prior to any integration into the QEC electricity system. The short-term options are:

- Hydro Electric Power: Iqaluit represents the largest potential market to reduce diesel consumption and also provides the best economics to support hydro-electric development. QEC has conducted an analysis of potential hydro-electric generation sites to serve Iqaluit. In time, other communities will also be evaluated.

- Waste Heat Recovery: QEC has district heating systems in Rankin Inlet and Iqaluit, which will save 2.3 million litres of fuel and reduce greenhouse gas emissions by 6,000 Tonnes of CO_{2eq}. Other community projects await funding.

- Wind Energy: wind turbines were first installed in Nunavut in 1988. Although wind power is not utilized commercially in Nunavut today, wind turbine and control technology is improving with the rapid expansion of the use of wind energy around the world and wind-diesel systems are in use in Newfoundland, Antarctica, Scandinavia and Alaska.

- Domestic Energy Resources: Nunavut has significant uranium, natural gas and oil reserves, which are not currently economic, but could become so as world prices for natural resources rise.

- Biodiesel: many northern and remote communities are cutting emissions of greenhouse gases by switching from pure petroleum diesel to B20, a mixture of 20 percent biodiesel and 80 percent diesel. For example in 2004-5, Ontario Hydro Remote switched its remote facilities at Bisco to B20, resulting in a slight increase in efficiency (2.65 to 2.73 kWh/L) and an eight percent decrease in greenhouse gas emissions.

Electricity Management Options

Demand-side management (DSM) programs consist of planning, implementing and monitoring activities designed to encourage consumers to modify their electricity usage. The primary objective of most DSM programs is to help defer the need for new sources of power, including generating facilities, power purchases, and transmission and distribution capacity additions.

QEC has initiated a number of demand-side activities including the creation of the Nunavut Energy Centre (NEC), which provides analysis, information and specific energy-efficiency programs to the Nunavummiut.

3 More information on the various renewable and domestic energy generation options is included in the Energy Supply Options Backgrounder.

Issues and Questions

In developing the energy strategy a number of issues need to be addressed. In keeping with Inuit Qaujimajatuqangit principles, we are presenting these issues as questions to encourage input and advice.

Questions

1. Should cost savings in energy be used to (a) reduce the price to consumers or (b) be invested in building a more efficient system, or (c) a combination of both?

2. Should communities continue to benefit from cross subsidization of energy prices? In other words, communities with lower electricity and fuel costs would pay higher rates so that all communities pay the same or similar price.

3. What factors need to be considered when investigating the potential of alternative energy sources such as hydro-power projects, wind power, solar energy, biodiesel fuel options, and waste heat-recovery systems for arctic climates?

4. Should Nunavut consider becoming involved in researching the viability of using small nuclear power plants for electricity generation?

5. Do you think that the GN should provide financial incentives, such as rebates, for energy efficient products to encourage their use?

6. Would you support the introduction of legislation, such as an energy efficiency act, to restrict the importation and sale of inefficient energy equipment in Nunavut?

7. How should the GN or QEC provide information on energy efficiency and clean renewable energy?

8. How aware are you of the availability of energy-efficient products?

9. Did you know that the GN subsidizes energy costs? If yes, do you think the current subsidy level is too low, about right, or too high?

10. Should the GN review the current structure of the energy subsidies and modify them so that it rewards public housing tenants, private citizens and businesses for the efficient use of electricity and fuel?

11. Do you think the GN should use the current subsidy system or should it provide a regular, direct energy allowance to people who live in the Territory?

12. Would you support lower subsidies in place of financial incentives that encourage people to conserve or use energy more efficiently?

13. Would a rebate system encourage you to conserve more energy? For example, if you reach a conservation target your energy bill would be credited with a "reward."

14. Do you think that the GN or QEC should provide financial assistance to consumers for the installation of solar walls and solar hot water heaters?

Conclusion

While opportunities for making real and positive changes in the energy sector are great, some difficult decisions lie ahead. Real solutions will require positive changes in consumer behavior, government operations and cooperation among governments, their departments and agencies. Education about true energy costs and the environmental consequences of energy choices is critical.

Displacement of some of the fossil fuels we use by other sources will result in favorable environmental impacts and also should result in a far greater portion of the economic benefit of energy being retained in Nunavut, even if the overall cost of energy is not significantly decreased.

Presently, energy represents a burden, but by taking a clear and careful look at our energy options, we can develop energy as a tool and resource for Nunavut's future.

Making a Submission

Anyone can make a submission about this discussion paper and what should be in the Government of Nunavut Energy Strategy. Submissions can be sent to:

Energy Secretariat
Energy Discussion Paper
Department of Executive and Intergovernmental Affairs
Box 1000, Station 204
Iqaluit, NU
X0A 0H0

Or emailed to energy_secretariat@gov.nu.ca

Submissions will be accepted up to April 30, 2007.

Please provide your name, address and telephone number. You may use the attached response form.

RESPONSE FORM

I am a: __Company Representative __Elder __Citizen

What I would like to see in our energy strategy:

What I would not like to see in our energy strategy:

Name: Address:

Signature:

Backgrounder: Role of Government

The Government of Nunavut (GN) plays a dominant role in the economy as its private sector is small. The GN directly or indirectly pays for energy consumption at schools, health facilities, government buildings, hamlets, a large percentage of housing, and for a significant number of vehicles. The GN pays nearly 80 percent of energy bills in Nunavut, consuming 20 percent of the government's overall budget.

It is essential for the success of Nunavut's future that the GN strengthens its leadership role in managing the energy system. Initiatives such as work-place behaviour changes (turning off lights and computers not in use) and other programs, such as conservation education, energy skills training and building retrofits, can offer broader returns in terms of skills, jobs and potential business opportunities, all of which will lead towards reductions in energy use and ultimately, energy costs.

The GN can also develop policies that encourage a move towards a more efficient and more cost-effective energy system.

Energy Reduction in its Own Jurisdiction

Energy reduction measures are a logical component of government efforts to reduce spending. In fact, this effort is already underway.

The Department of Community and Government Services (CGS) is responsible for managing all of the GN's buildings and paying the energy bills. CGS introduced the Nunavut Energy Management Program (NEMP) in 2005-2006. The three elements of the NEMP are: changing the behaviour of the GN's employees and building occupants through awareness programs; ensuring that new buildings are built to the best available energy-efficiency standards; and, retrofitting existing buildings.

With NEMP the GN uses future energy savings to repay third party energy efficiency and renewable energy investments in its facilities. The Iqaluit pilot project, to be completed by March 2008, will be the largest energy management project in Nunavut and will address 29 percent of the GN-owned building stock.

Through a series of "quick start quick payback measures," CGS has implemented $750,000 in projects that will pay for themselves in less than three years.

By introducing 'Save 10' (energy efficiency awareness program), the GN is beginning the process of instill an "energy-efficient ethic" in its employees and building occupants. More information on the Save 10 program can be found at www.gov.nu.ca/Save10/

Policy and Program Development and Implementation

Compared to other regions in Canada, there is a short history of energy-related policies and programs in Nunavut. Work needs to start with tracking of energy use, costs and associated greenhouse gas emissions so that the effectiveness of energy management efforts can be

measured and reported to the public. If the government is to effect change, baseline information is essential for the design of energy reduction initiatives.

The GN's future policy or policies can include a variety of actions beyond the information, training and innovative financing efforts that are currently underway.

The following policy development and analysis, regulatory, persuasion and technology development tools are widely used in other jurisdictions and could have a significant role in Nunavut:

Regulatory Tools

- Equipment Regulations and Standards

An Energy Efficiency Act: regulations under an energy efficiency act would set minimum energy-performance levels for energy-using products such as appliances, lighting, and furnaces. The Government of Canada introduced its *Energy Efficiency Act* in 1998. Because of jurisdictional issues it only restricts the transport of goods into Canada and across provincial borders. Consequently, a number of provinces have introduced energy efficiency acts.

As the cost of fuel oil and electricity is significantly higher in Nunavut than in Southern Canada and is heavily subsidized by the government it may be in the interest of the GN to develop its own energy efficiency act.

- New Buildings

The energy-efficiency performance of buildings is embedded in the National Building Code, which is a voluntary building code until adopted by provincial governments. The GN applies its best practices guidelines to all of its new buildings to ensure that they are efficient.

Procurement Tools

Governments can use their buying power to influence the market for energy- efficient products and services by adopting green purchasing policies. For example, the GN and the housing authorities could affect the market for light bulbs by only purchasing high quality, compact fluorescent bulbs and insisting that local merchants stock these as replacement bulbs.

Changing Individual Behaviour

- Market Research Tools

The foundation of any behaviour change program is solid market research and barrier analysis. By understanding why an individual or organization fails to act in an energy-efficient manner, an organization can identify the barriers and the transaction costs associated with the activity and then select the appropriate instrument to use.

- Persuasion Tools

Governments can use information, education and financial incentives or disincentive tools to encourage consumers to purchase the best available energy-efficient product, home or vehicle.

- Awareness, Information, Education Tools

Governments and utilities design and deliver many types of information and education programs. Unfortunately, many government and utility information programs are unsuccessful because they fail to understand the barriers to action. They fail to deliver the right information, in the right format, to the right person, at the right time. Program evaluations have shown again and again that programs that rely solely on providing information have little or no effect on behaviour. Successful programs are almost always well researched and use a combination of information and financial tools.

- Financial Incentive Tools

Government financial tools can be grants, contributions for a certain percentage of costs, tax incentives, rebates, low or no interest loans, or a combination of the various incentives. Many utility and government financial incentive programs start quickly but falter after the early adopters have participated in the program.

Technology, Research, Development and Deployment Tools

With its high energy costs, Nunavut is positioned to become an "energy efficiency and renewable energy showcase". This can be done at the equipment, building and community level.

By working with manufacturers, the GN can retrofit its building lighting-control systems with a state-of-the-art control system, save money and become a showcase for technology. At the same time the GN will be seen as a model of how arctic communities can manage energy systems in an affordable and environmentally responsible manner.

Backgrounder: Subsidies

The GN subsidy programs are multi-layered and complex, making it difficult to monitor and track energy subsidies. As a result, the true cost of providing Nunavut's energy requirements is difficult to ascertain. Most Nunavummiut do not know the true level of subsidization because of this complexity. This dearth of information is one reason the GN comes under pressure to increase subsidies whenever world oil prices rise.

Electricity power rate subsidies include the Nunavut Electricity Subsidy Program (NESP), social housing subsidy, a small business subsidy and a Department of Education Elders subsidy.

Table 1. Summary of the actual and estimated 2005-06 GN energy subsidies

Subsidy Source	Electricity	Fuel	Total
GN	$6,252,330	$4,152,770	$10,405,110
Housing	$11,338,000	$9,641,000	$11,338,000
Senior program	$384,735	$122,770	$507,505
Total	**$17,975,065**	**$13,916,540**	**$31,916,540**

CGS funding increase for fuel	$1,797,000
Indirect subsidies	$10,125,490
Total Energy Subsidies	**$43,839,030**

In total, the GN's energy subsidies amounted to over $43.8 million in 2005-06, averaging out to $1,500 for every person in Nunavut.

Fuel subsidies are not always visible to consumers. The Petroleum Products Revolving Fund is an example. Every year the GN sets aside an amount of money in the Petroleum Products Revolving Fund to pay for the fuel to be delivered during the summer shipping season. The GN sets a retail price to enable it to recover, over 12 months, the cost of the annual purchase. However, there have been occasions when the amount received from retail sales was not enough to cover the purchase cost.

In recent years the GN has opted to transfer money into the Revolving Fund instead of asking consumers to make up the difference. Last year, the fuel price would have been 10 cents a litre higher if the GN had opted for full-cost recovery from consumers.

As well, all costs are not reflected in the calculated fuel price. Fuel purchasing costs are calculated as being the landed cost of fuel products, taking into consideration any prior year's remaining fuel in inventory. Operating costs include commissions paid, labour, travel, material, supplies, utilities, office equipment, and purchased and contract services. The consumer is not charged for related service costs, such as amortization of the tank farms, financing, insurance and other support services charges provided by other GN agencies.

Affordable Energy Fund (AEF)

In 2003 legislation was passed to create an affordable energy fund, but has not yet been proclaimed. This fund will enhance the Government's ability to monitor existing energy support for consumers, provide resources to advance energy consumption reduction projects, capture subsidy dollars for conservation promotion, and manage energy subsidies.

The Affordable Energy Fund would consolidate a variety of existing fuel and electricity subsidy programs. This approach will facilitate management of subsidies by providing a focus on subsidy

dollars, quarterly accountability by fund managers and an emphasis on energy conservation. As well, the AEF would direct existing electricity and fuel subsidies through an annual appropriation to the Fund.

It is expected the legislation will be proclaimed November 1, 2007, which is when the Fund will become operational.

Backgrounder: Public Housing

Forty six percent of dwellings in Nunavut are public housing units. As with most public housing in Canada, there is a building renewal liability that has been allowed to grow because of tight budgets and the need to divert renewal funds to pay the energy bills.

Tenants do not pay for heating and electricity is heavily subsidized. For example in Iqaluit public housing, tenants pay $0.06 per kWh for unlimited electricity, whereas private homeowners pay $0.195 per kWh for the first 700kWh (1,000 kWh in winter months) and $0.395 above this ceiling.

In 2005-06, the GN paid an electricity bill of $11,338,000 and a heating bill of $9,641,000 for public housing. If public housing can generate an economic saving of 15 percent to 20 percent by adopting modest retrofit measures, rather than complete rebuilds, annual savings in the order of $3.15 million to $4.2 million may be realized.

Nunavut Housing Corporation estimates that approximately 25 percent of public housing units in Iqaluit are 25-30 years old and do not meet energy-efficient standards. The cost to bring these units up to an acceptable efficiency standard, as calculated in 1997, would be about $110,000 - $115,000 for a dwelling of 675 square feet. This has since been revised to $200,000. A newly constructed energy-efficient 800 square foot residence costs about $278,000. While energy conservation measures such as replacing single-pane windows are beneficial, the cost of achieving larger savings present challenges. In the longer term, the construction of new public housing that meets current energy-efficiency standards will produce the most cost-effective results.

There has been little or no public debate about the level of energy subsidies in public housing. Perhaps this is because there is a fear that lower subsidies would add an unfair burden to a territory that is already struggling with a major housing deficit and with a large stock of substandard housing. There is a danger that an increase in the cost of energy may result in low-income earners being tipped into the income support system.

Backgrounder: Energy Efficiency and Demand Management Programs

Nunavut Energy Management Program

The Department of Community and Government Services (CGS) is responsible for the Nunavut Energy Management Program, a program which seeks to reduce energy use within the GN. The GN's 518 buildings consumed more than $14 million of water, electricity and fuel in 2002-03. Rising energy costs and a growing GN building portfolio underline the need for such an energy management program.

Approximately $750,000 of electrical retrofit work was identified and completed in Iqaluit in 2005-06 on various GN facilities. Savings realized from this work will enable the cost to be recovered within three years.

Nunavut Energy Centre

The Nunavut Energy Centre (NEC) was established to develop and enhance energy efficiency and support initiatives to reduce greenhouse gases across Nunavut. Qulliq Energy Corporation manages and provides the large majority of the annual budget for the Nunavut Energy Centre (NEC), which is located in Iqaluit.

It will work to reduce energy use through a public outreach program on energy management, efficiency, and conservation, and technology deployment; a data collection, analysis, reporting and information service on energy use, and by assisting Nunavummiut in conserving energy.

NEC's Planned Programs

- Energy Audit for Home Owners

The *Energy Audit for Home Owners* will be conducted by contractors selected through a competitive process. A contractor will train NEC and QEC staff, and where possible, train interested parties in Nunavut communities. The contractor will also undertake inspections on owner-occupied homes. QEC will arrange an evaluation that will include an estimate of cost reductions that might be realized through the introduction of energy-efficiency measures. Homeowners will pay for part of the cost of an evaluation.

- Energy Efficiency Appliance Program

The *Energy Efficiency Appliance Program* will enable local retailers and suppliers to provide access to energy-efficient appliances, such as clothes washers, dishwashers and refrigerators. The NEC is currently determining the cost of rebates.

- Public Information Campaign

A broad *Public Information Campaign* will provide Nunavummiut with both general and specific information on energy use and conservation. It will also serve to inform Nunavummiut on energy options and commercially available choices.

- Community Energy Pilot Projects

The Nunavut Energy Centre has developed a business plan that includes a project to analyze the total energy consumption for two high-energy cost communities.

Energy consumed by the entire community will be tracked and calculated over a year. With the assistance of the community, approaches to energy conservation will be developed and an energy reduction target will be set. Conservation measures and capital investments can be initiated to reduce consumption.

This project's success and economic benefit will be evaluated and used in other high-cost communities, generating savings and experience in conservation approaches year over year.

Backgrounder: Energy Supply Options

Hydro Electric Power

Iqaluit burns about 12 million litres of fuel each year to generate electricity, which is one-third of the total consumed for electricity generation in Nunavut. Iqaluit with its nine megawatt peak demand and rapid growth presents the largest potential market to reduce diesel consumption and also provides the best economics to support hydro-electric development.

QEC has conducted an analysis of potential hydro-electric generation sites to serve Iqaluit. Several sites are being assessed. The sites range from 3.4 megawatts to 20 megawatts. Construction could start during the period of 2009 to 2011 and the work will likely take two to three years. In due course, sites at or near other communities will also be evaluated.

Wind Energy

Wind turbines have existed in four Nunavut communities since 1988. The communities are:

- Igloolik in 1988
- Cambridge Bay in 1994
- Kugluktuk in 1996
- Rankin Inlet in 1998

Currently, wind power is not utilized commercially in Nunavut. Problems have been encountered with wind turbine foundations, operation of control and brake systems, and lack of trained personnel for routine maintenance. However, in spite of the problems that were experienced in Nunavut with some of the earlier units, wind power is being used with success in other arctic regions. Technological advances continue and increased demand for wind-power systems have led to cost reductions. Some examples are:

Antarctica: the Australian Government installed a wind-power system at the Mawson Research Station in Antarctica in 2003. The station's electricity comes from two wind turbines and a diesel generator. Power generation switches between the wind turbines and the diesel generator. The turbines are used year round and are exposed to wind gusts of more than 180 km/h and temperatures of -36C.

Newfoundland: the community of Ramea has been the location of a pilot project with wind and diesel generation since 2004, and projects have been launched to combine hydro with wind and diesel generation in remote communities.

Photovoltaic Cells

A 3.2 kWp grid-connected photovoltaic (PV) system was installed on the façade of Arctic College's Nunavut Campus in 1995. The PV system has delivered around two mWh of electrical power on an annual basis with no interruption of delivery, except for times when the AC power in the building was down. The project successfully demonstrated the potential of grid-connected photovoltaics in Nunavut. As the efficiency and performance of PV systems improve and the costs decrease, this technology will be more attractive to energy consumers in Nunavut.

Biomass and Energy from Waste

Biomass includes the use of methane gases from landfill sites and the production of heat or electricity generation from waste. As Nunavut's communities grow their waste disposal problems increase. One solution could be to generate electricity or heat from the waste.

Nuclear

The small Alaskan community of Galena is moving ahead with studies aimed at the possibility of using nuclear power. The small community is looking at the possibility of using a nuclear reactor, known as the Toshiba 4S (for super safe, small and simple) to generate 10 megawatts of power.

Space and Water Heating

District Heating Program

District heating systems use the heat created by the production of electricity. By installing heat exchangers on the cooling and exhaust systems of the generators heat that is normally exhausted into the environment can be captured and delivered through insulated piping to nearby buildings connected to the system. An energy transfer station controls, measures and transfers the required heat to the existing heating system within a building.

QEC is completing systems in Rankin Inlet and Iqaluit and anticipates the projects will be operational by the end of the 2006-07 fiscal year. The Rankin Inlet and Iqaluit systems will save 2.3 million litres of heating fuel and reduce greenhouse gas emissions by almost 6,000 tonnes annually.

The Rankin Inlet project is an extension of an existing system. It will distribute heat to GN buildings, Nunavut Arctic College, the arena, the water treatment plant, the high school, the new health centre and five commercial buildings.

Iqaluit already utilizes heat from generators to supplement the Nunavut Power Plant heating requirements. The next phase includes the installation of distribution piping and energy transfer stations for the water treatment plant, city pump house and the Baffin Regional Hospital.

Future plans in Iqaluit include the extension of the heating system to Inuksuk High School, CBC Building, Nunavut Arctic College and the new Nunavut Court of Justice building. Viable projects exist in several other communities, but funding sources are still being sought.

Solar Water Heating

Solar water heating systems use energy from the sun to heat or pre-heat domestic hot water or for certain process water requirements. The solar heating collectors are typically mounted on a south facing roof. The collector material is a copper absorber that can either be mounted in a glazed frame or evacuated glass tubes. In cold climates, food grade glycol is typically used as a heat transfer fluid to deliver heat from the collector surface to the water stream.

Solar Air Heating

Using the solar gain in the winter and shoulder months, the solarwall system is a method of pre-heating the outdoor air that is delivered to an air-handling unit. This approach uses a passive heating and ventilating system comprising a darkly coloured, perforated metal cladding which transfers heat to the outside air through perforations in the wall.

The solarwall is built onto an existing wall, with south or west-facing walls having the best orientation for the wall to capture the heat from the fall, winter or spring sun. The preheated air is then ducted to an existing air handling unit and is drawn into this unit by the negative pressure created by a fan. A solarwall system is in use at the high school in Rankin Inlet.

Geothermal Systems

Geothermal systems work in many places. They are based on the fact that the temperature below the frost line is fairly constant. The ground is warmer in the middle of winter and cooler in the middle of summer than the outside air.

A geothermal system is typically based on a single system that can be used for both heating and cooling, eliminating the need for separate furnace and air-conditioning systems. It can also heat water at no additional cost.

An earth-energy system uses a series of buried pipes to transfer the heat from the ground into a building during winter, converting it into warm air and distributing it through ducts. The system can be configured as either a closed or open loop, and the loop itself can be either horizontal or vertical. Closed-loop systems circulate a fluid mixture within the buried pipes, while open-loop systems circulate well or surface water.

Research has not been undertaken in Nunavut to determine the suitability of biomass or geothermal systems nor to determine the best approaches to protecting the permafrost.

Domestic Energy Supply Options

Nunavut is a new and very large territory with a wealth of natural resources including, hydro-electricity, uranium, natural gas and oil reserves.

Oil and Gas Reserves

Nunavut is fortunate in having five percent of Canada's known oil reserves and 15 percent of Canada's known reserves of natural gas. At today's prices the reserves are worth at least $80 billion. These reserves could be a major source of royalty payments to the GN, provided it achieves a devolution agreement with the federal government. The GN is in the preliminary stages of talks with the federal government for a devolution agreement that would give Nunavut province-like powers over its natural resources.

The timing of development of these reserves depends on world oil price projections. It has been estimated that the cost to extract a barrel of oil in Nunavut is about $100 a barrel. According to some projections, it will be at least 10 years before petroleum companies focus on developing Nunavut's reserves, but this could change if the volatile, world oil price increases dramatically and remains at a high level.

The fact that Nunavut has an abundant supply of fossil fuels does not mean that the majority of Nunavut's oil and gas will be used within the Territory for power generation or for heating and transportation. Instead, most of the reserves will be exported out of the Territory for processing. The benefits associated with oil and gas will come primarily from taxation and royalty payments, along with associated activities such as training, local jobs and investment spending.

Uranium

The price of uranium on international community markets has doubled to $75 per pound in the last year, thanks to increasing demand for the radioactive metal which is used to fuel nuclear reactors. Concern about climate change from greenhouse gases stemming from the use of fossil fuels is encouraging some countries and electricity generators to expand nuclear generation capacities. Nuclear stations do not produce greenhouse gases, but do create radioactive waste material.

With uranium prices at an all-time high and with no new major mining projects set to come on line anywhere in the world, it is likely Nunavut's uranium reserves will soon attract serious attention of uranium miners. Nunavut will soon have to decide whether it opposes uranium mining, or whether it will allow mining with conditions.

Backgrounder: Climate Change

Global concentrations of greenhouse gases have increased markedly as a result of human activities since 1750. The global increases of carbon dioxide concentrations are primarily due to fossil fuel use. The result will be global warming of between 2C and 4C by the end of the century, a melting of arctic sea and land ice, and an increase in the depth of the active permafrost.

Nunavut generates all of its electricity, heats its homes and water, and transports its goods and people by burning fossil fuel, thereby generating greenhouse gases. Although our population is small and our portion of Canada's greenhouse gas output is less than 0.1 percent, we are still part of the problem.

In 1998, Canada signed the United Nations Kyoto Accord and agreed to reduce its greenhouse gas emissions to six percent below 1990 levels by the year 2012. Canada is currently 23 percent above 1990 levels. Public opinion in Canada strongly supports an increased effort by all levels of government to reduce greenhouse gases. The Government of Canada has drafted a *Clean Air Act*, which will use a combination of regulations, incentives and research and development to increase Canada's action on climate change.

Nunavut was the first jurisdiction in Canada to sign a Memorandum of Understanding on climate change. The MOU was signed on October 31, 2003, and indicates agreement to work on reducing greenhouse gas emissions. If Nunavut is to meet its portion of Canada's greenhouse gas reduction target, it will need to reduce greenhouse gases to six percent below 1990 levels.

Backgrounder: Acronyms

GN	Government of Nunavut
CGS	Department of Community and Government Services
PPD	Petroleum Products Division
QEC	Qulliq Energy Corporation
NHC	Nunavut Housing Corporation
NEC	Nunavut Energy Centre
NEMP	Nunavut Energy Management Program